

# Molecular nanoarchitectures from on-surface reactions and assembly

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One of the goals of nanoscience is achieving precise control over the structure and function of nanoscale architectures at surfaces. Bottom-up approaches using molecular building blocks present a flexible and intuitive approach to this challenge. Combining the Lego-like modularity of molecules with the epitaxial and reactive influences of surfaces creates a range of opportunities to build exciting new nanoarchitectures.

On-surface synthesis can potentially allow for the fabrication of extended covalent nanostructures with enforced planarity. I will discuss our recent work in studying the reactions of halogenated and carboxylated molecules at metal surfaces, where we have been focussing on understanding the effect of heteroatoms in the coupling reaction and the subsequent formation of oligomeric and polymeric structures, using a combination of scanning tunnelling microscopy, photoelectron spectroscopy and near-edge x-ray absorption fine structure to gain a well-rounded insight into the process.

While our focus with these molecules has been primarily on one-dimensional nanostructures, we have simultaneously been exploring the use of two-dimensional covalent organic frameworks (COFs) as templates for the solution-based self-assembly of organic semiconducting building blocks. Boronic-acid based COFs provide a quick and easy two-dimensional nanotemplate that can be used to pattern a range of guest molecules, predictably positioning them in films ranging from monolayer to multilayer thicknesses.[1-2] The packing in these host/guest architectures can be tuned through the choice of solvent employed,[2-3] providing an avenue to the controlled growth of patterned films of fullerenes and other molecules.

## References:

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- [3] D. Cui, J. M. MacLeod, M. Ebrahimi, and F. Rosei. *CrystEngComm* **19**(33) 4927 (2017).